# Synopsis

## Title of the Thesis :

## "Kinetic and Mechanistic study of Oxidation of Reducing Sugars in presence of Micelle"

## Introduction:

The carbohydrates are a group of chemical compounds which have always been of great theoretical interest to the students of organic chemistry. The splendid contribution from this area of our science have become milestones in general chemical progress. Carbohydrate is present in the form of sugar in blood as "blood sugar". Some carbohydrates find a number of applications in the field of molecular biology, pharmaceuticals and bioengineering.

N-halo compounds have also been widely used as halogenating reagents of organic compounds[1.]Various N-haloimides, which have been used as analytical reagents are N-bromoacetamide, N-bromosuccinamide, N-bromophthalimide and N-bromobenzamide. N-bromophthalimide has very active polar N-Br bond. For example, NBP has diverse nature due to its specific property as it provides free NBP, $HN^{+}BP$ , $Br^{+}$, HOBr, $H_2OBr^{+}$ and other species in acidic medium , whereas in the absence of mineral acids, it provides very reactive oxidizing species. Therefore, these reagents interact with various organic compounds.

Surfactants are wetting agents that lowers the surface tension of a liquid, allowing easier spreading and lower the interfacial tension between two liquids. A cationic surfactant contain positive charge group on its head whereas an anionic surfactant contain a negative charge group on its head.

## A Brief Review of the work already done in the field :-

The general survey of the literature reveals that N-halo compound (N-bromophthalimide) and (N-bromosuccinamide) is an important member of N-haloimides with active bromine. The compound $C_8H_4BrNO_2$ known as N-bromophthalimide (NBP) is strong oxidizing agent and brominating agent . It is stable in the solid state when kept in the absence of light and moisture.

Several studies have been reported on the kinetics of oxidation of various carbohydrates by different oxidizing agents like metal ion N- halo compounds and other oxidants[2-7.]

The oxidation product of carbohydrates, lactone of aldonic acid, was detected.

$(C_6H_{12}0_6)$ + N-haloamide + $H_2O$ $\longrightarrow$ Lactone of aldonic acid + amide
monosaccharide oxidant

## Noteworthy contribution in the field of proposed work:-

Although very extensive work has been reported in the field of oxidation of carbohydrates by different oxidizing agents like N-bromoacetamide, very little work has been done with N-bromophthalimide and N-bromosuccinamide oxidant, particularly in the presence of surfactants like CTAB and SDS. These surfactants, at a particular concentration, known as Critical Micelle Concentration (CMC) begin to form micelle.

The Phenomenon of this micellar catalysis is the latest subjects of investigation in the field of chemical kinetics[40-45]. Although the study of variety of catalytical oxidation is well known.

This promoted us to study the kinetics and mechanism in micellar catalysed oxidation of biologically important substrates (reducing sugars) by an acidic solution of N- halo compounds[46-50].

## Proposed methodology of research work :-

Proposed is the kinetic study of oxidation of some carbohydrates by N – Halo compounds in the presence of micellar system in acidic medium. The study will be on the basis of following points:

1. To determine the order of reaction with respect to oxidant concentration on the reaction rate.
2. To determine the order of reaction with respect to substrate (Reducing Sugars concentration on the reaction rate).
3. To study the effect of variation of surfactant concentration on the reaction rate.
4. To study the effect of $[H^+]$ ion on the reaction rate.
5. To study the effect of change of dielectric constants of the medium ( acetic acid) on the reaction rate.
6. To study the effect of halide ions and one of the product of oxidant on the reaction rate.
7. To study the stoichiometry of the oxidation reaction.
8. The evaluation of various kinetic and activation parameters.

The rate dependence of the reaction with respect to oxidant will be determined by Ostwald's isolation and initial concentration methods. The progress of reaction will be studied by estimating the oxidant spectrometrically or iodometrically. Desired amount of N- halo compounds, additives and surfactant will be taken in a vessel at required temperature. In another vessel required volume of reducing substrate will also be taken. When solution of both vessels attain the desired temperature, these solutions were vigorously mixed and time for mixing will be noted. The mixture will be taken in a cuvette and kept in spectrophotometer for observation by setting up a certain time interval of reading. The readings will help in the determination of order of reaction with respect to oxidant, substrate, additives, surfactant etc. in various condition. These data will help in elucidating reaction mechanism of catalyzed reactions ( micellar system).

The related kinetic parameters will be studied by standard known methods.

## Expected outcome of the proposed work :-

Some reducing sugars will be subjected to micellar catalyzed oxidation. For each reducing sugars, following shall be the expected outcome of the proposed study:

1. Determination of basic kinetic parameters such as order of reactions with respect to substrate (reducing sugar) and oxidant for the oxidation reaction of reducing sugars by N – halo compounds.

2. Effect of $[H]^+$ ion on the reaction rate.

3. Effect of acetic acid, mercuric acetate, amides and salts on the oxidation of reducing sugars.

4. Effect of cationic surfactant (CTAB), anionic surfactant (SDS) on the oxidation of reducing sugars.

5. Effect of temperature on the kinetics of oxidation of some reducing sugars by N – halo compounds.

6. Identification of the reactive species of the oxidant.

7. Determination of CMC in presence of substrate and oxidants, ionization degree ($\alpha$), counter ion binding ($\beta$).

A most probable reaction mechanism will be proposed on the basis of experimental results and findings.

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